REMARKS/ARGUMENTS

Claims 28 – 52 are pending in the application.

Claims 28, 43, 49, and 50 have been amended. New independent claims 51 and 52 have been added.

In the Office Action, claims 28, 43, 49, and 50 are objected to as comprising informalities. Applicants have amended claims 28, 43, 49, and 50 in accordance with the suggestions in the Office Action and therefore submit that the amended claims 28, 43, 49, and 50 do not now comprise any informalities.

Also, in the Office Action, claims 28, 31 - 36, 39, 38, 41 – 44, 49, and 50 are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent No. 6,274,510 to Wilk et al in view of US Patent No. 5,913,149 to Thakur et al. Additionally, in the Office Action, claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,274,510 to Wilk et al in view of US Patent No. 5,913,149 to Thakur et al as applied to claims 28, 31 - 36, 39, 38, 41 – 44, 49, and 50 and further in view of Applicants Admitted Prior Art. Furthermore, in the Office Action, claims 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,274,510 to Wilk et al in view of US Patent No. 5,913,149 to Thakur et al as applied to claims 28, 31 - 36, 39, 38, 41 – 44, 49, and 50 and further in view of US Patent No. 6,087,229 to Aronowitz et al. Moreover, in the Office Action, claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent No. 6,274,510 to Wilk et al in view of US Patent No. 5,913,149 to Thakur et al as applied to claims 28, 31 - 36, 39, 38, 41 – 44, 49, and 50 and further in view of US Patent No. 6,218,720 to Gardner et al.

With regard to claims 45 and 47, which were not rejected as anticipated by, or

obvious in view of, the prior art, Applicants have rewritten these claims as independent claims 51 and 52, respectively.

Applicants respectfully submit that claim 28 as now amended patentably defines over Wilk et al '510 and Thakur et al '149 for the reasons set forth below.

Claim 28 as now amended recites a method of generating defects in a lattice structure of a semiconductor material during thermal treatment of the material. The method includes subjecting the semiconductor material comprising foreign atoms to a treatment protocol comprising a preliminary step and a later step which occurs after the preliminary step. The preliminary step includes controlling at least one of a concentration and a distribution of defects or vacancies as a function of a process gas atmosphere such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material. Also, in accordance with the method recited in amended claim 28 of the present application, the later step of the treatment protocol includes either producing an $Si_xO_yN_z$ oxy-nitride layer having a thickness of up to 2nm (20 angstroms) directly on a surface of the semiconductor material or producing an Si_3N_4 layer having a thickness of up to 4nm (40 angstroms) on the semiconductor material directly at a location on the surface of said semiconductor material at which a natural SiO_2 layer has previously been removed prior to the thermal treatment of the semiconductor material.

The defects in the lattice structure generated by the method recited in amended claim 28 can include, as recited in claim 29, so-called vacancies or, as recited in claim 30, semiconductor substrate atoms on interstitial lattice positions. The defects that are

produced influence the diffusion characteristics of foreign atoms within the semiconductor material.

Wilk et al '510 discloses a method for forming a thermal silicon nitride on a semiconductor substrate. The method includes providing a 4 nm layer by a thickening method involving first forming a highly uniform silicon nitride layer 16 on a silicon surface 12, depositing a uniform silicon layer 18 on the silicon nitride layer 16 and then exposing this new silicon surface to another ammonia atmosphere 14 to form a single Si--N layer 20. In this step, the total thickness of nitride layer 20 is determined by the thickness of the silicon 18 and the underlying Si--N layer 16. If necessary, this silicon deposition and nitridation can be repeated to form thicker layers.

Thakur et al '149 discloses a semiconductor substrate 10 that is atomically cleaned to remove a native silicon dioxide layer 70. The process involves providing an atomically cleaned substrate 10 into a chamber 88 and a first dielectric layer 20 is provided superjacent the atomically clean substrate 10, this first dielectric layer 20 being grown by relying on the principles of Rapid Thermal Nitridation ("RTN"). The substrate 10 is exposed to a gas and heat and, by employing a nitrogen based gas, the first dielectric layer 20 is formed comprising silicon nitride. This is followed by the deposition of a first nitride layer using Chemical Vapor Deposition ("CVD"), Low Pressure Chemical Vapor Deposition ("LPCVD"), Molecular Beam Epitaxy ("MBE"), etc. The first dielectric layer 20 is thus formed by RTN and deposition of a nitride film.

It is respectfully submitted that Wilk et al '510 neither teaches nor suggests the treatment protocol including the preliminary step and the later step which occurs after the preliminary step as recited in amended claim 28 of the present application.

Specifically, it can be seen that Wilk et al '510 provides no teaching nor suggestion concerning such a two-step treatment protocol in which the preliminary step includes controlling at least one of a concentration and a distribution of defects or vacancies as a function of a process gas atmosphere such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material. Instead, Wilk et al '510 discloses forming a highly uniform silicon nitride layer on a silicon surface and depositing a uniform silicon layer on the silicon nitride layer. Wilk et al '510 provides no hint of the desirability of, let alone any disclosure or teaching of, creating vacancies or defects in the semiconductor substrate such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material. In view of this absence of any hint or teaching in Wilk et al '510 with respect to creating vacancies or defects in the semiconductor substrate to control the subsequent concentration and diffusion of foreign atoms, it is clear that Wilk et al '510 cannot possibly provide any hint or teaching concerning the further detailed step, recited in claim 28 as currently amended, that the creation of vacancies or defects in the semiconductor substrate is controlled as a function of a process gas atmosphere.

Applicants also submit that Thakur et al '149 likewise provides no teaching or suggestion of the method recited in amended claim 28. Instead, Thakur et al '149 merely discloses forming a first dielectric layer 20 on an atomically clean substrate 10 and does not provide any teaching or disclosure to one of skill in the art concerning

creating vacancies or defects in the semiconductor substrate such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material, let alone any teaching or disclosure of the two-step treatment protocol recited in amended claim 28.

Applicants note that the mere fact that the prior art teaches the formation of an $Si_xO_yN_z$ oxy-nitride layer or an Si_3N_4 silicon nitride layer does not provide any hint or motivation to one of ordinary skill in the art concerning the method recited in amended claim 28. The method recited in amended claim 28 comprises the step of forming an $Si_xO_yN_z$ oxy-nitride layer or an Si_3N_4 silicon nitride layer but it is not Applicants contention that forming an $Si_xO_yN_z$ oxy-nitride layer or an Si_3N_4 silicon nitride layer itself is novel; instead, this step of forming an $Si_xO_yN_z$ oxy-nitride layer or an Si_3N_4 silicon nitride layer is in implementation of the inventive concept of creating vacancies or defects in the semiconductor substrate such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material.

In short, it is submitted that Wilk et al '510 and Thakur et al '149 are merely representative of a recognition in the prior art that defects may occur during the thermal handling of a semiconductor substrate (and, in fact, Wilk et al '510 and Thakur et al '149 echo the prior art teaching that the formation of such defects is not desired).. Accordingly, neither Wilk et al '510 nor Thakur et al '149, alone or in combination, nor any of the other cited prior art, can be seen to provide any hint or motivation to one of

ordinary skill in the art to control the formation of defects or vacancies such that the subsequent concentration and diffusion of foreign atoms within the semiconductor material are influenced by the newly created respective concentration or distribution of defects or vacancies in the semiconductor material.

Applicants respectfully submit that claim 28 as now amended patentably defines over Wilk et al '510 and Thakur et al '149 and submit that claim 28, and claims 29 - 49 depending ultimately therefrom, are allowable. Additionally, Applicants submit that independent claim 50 is allowable for at least the reason that claim 28 is allowable. Also, it is submitted that new independent claims 51 and 52 are in condition for allowance.

In view of the foregoing discussion, Applicants respectfully request reconsideration of the allowability of all of the claims of the instant application. Should the Examiner have any further comments or suggestions, the undersigned would very much welcome a telephone call from him in order to be able to discuss any outstanding issues and to place the application into condition for allowance.

Respectfully Submitted,

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